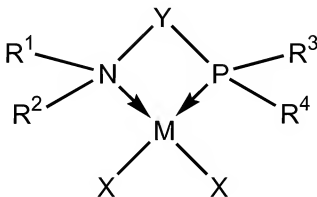


Listing of Claims

The listing of claims below replaces all prior versions, and listings, of claims in this application:

1. (Canceled)
2. (Previously Presented) A composition of matter with the following formula:



wherein

- (a) M is a Group-8, -9, or -10 transition metal, excluding palladium,
- (b) N is nitrogen;
- (c) P is phosphorus;
- (d) R^1 , R^2 , R^3 , and R^4 are hydrocarbyl radicals;
- (e) Y is a hydrocarbyl bridge comprising a backbone wherein the backbone comprises a chain that is four or more carbon atoms long; and
- (f) each X is independently methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl,

pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, hydride, phenyl, benzyl, phenethyl, tolyl, methoxy, ethoxy, propoxy, butoxy, dimethylamino, diethylamino, methylethylamino, phenoxy, benzoxy, allyl, 1,1-dimethyl allyl, 2-carboxymethyl allyl, 1,1,1,5,5,5-hexa-fluoroacetylacetonate, 1,1,1-trifluoro-acetylacetonate, and 1,1,1-trifluoro-5,5-di-methylacetylacetonate; or the two X's are connected to form catecholate, 3,5-dibutylcatecholate, 3,6-dibutylcatecholate, 3,6-dibutyl-4,5-dimethoxycatecholate, 3,6-dibutyl-4,5-dichlorocatecholate, 3,6-dibutyl-4,5-dibromocatecholate, 1,3-propylene, or 1,4-butylene.

3. (Previously Presented) The composition of matter of Claim 2 wherein R^1 , R^2 , R^3 , and R^4 are C_1 - C_{40} hydrocarbyls.

4. (Previously Presented) The composition of matter of Claim 3 wherein R^1 , R^2 , R^3 , and R^4 are C_1 - C_{30} hydrocarbyls.

5. (Previously Presented) The composition of matter of Claim 4 wherein R^1 , R^2 , R^3 , and R^4 are methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, ethenyl, propenyl, butenyl, pentenyl, hexenyl, heptenyl, octenyl, nonenyl, decenyl, undecenyl, dodecenyl, ethynyl, propynyl, butynyl, pentynyl, hexynyl, heptynyl, octynyl, nonynyl, decynyl, undecynyl, dodecynyl, phenyl, benzyl, phenethyl, tolyl, cyclobutyl, cyclopentyl, cyclohexyl, cycloheptyl, cyclooctyl, cyclononyl, cyclodecyl, or cyclododecyl radicals.

6. (Previously Presented) The composition of matter of Claim 5 wherein R^1 , R^2 , R^3 , and R^4 are methyl, ethyl, propyl, butyl, cyclohexyl, phenyl, tolyl, benzyl, or phenethyl.

7. (Canceled)

8. (Canceled)

9. (Previously Presented) The composition of matter of Claim 2 wherein both X ligands are dimethylamino, diethylamino, methylethylamino, phenoxy, or benzoxy.

10. (Previously Presented) The composition of matter of Claim 2 wherein both X ligands are independently methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, hydride, phenyl, benzyl, phenethyl, or tolyl.

11. (Previously Presented) The composition of matter of Claim 2 wherein both X ligands are independently allyl, or 1,1-dimethyl allyl.

12. (Previously Presented) The composition of matter of Claim 2 wherein M is selected from the group consisting of nickel, iron, cobalt, platinum, ruthenium, rhodium, and iridium.

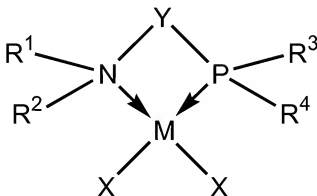
13. (Previously Presented) The composition of matter of Claim 12 wherein M is iron, nickel, or cobalt.

14. (Previously Presented) The composition of matter of Claim 12 wherein Y is selected from the group consisting of butylene, pentylene, hexylene, heptylene, octylene, nonylene, decylene, undecylene, dodecylene, tridecylene, tetradecylene, pentadecylene, hexadecylene, heptadecylene, octadecylene, nonadecylene, eicosylene, heneicosylene, docosylene, tricosylene, tetracosylene, pentacosylene, hexacosylene, heptacosylene, octacosylene, nonacosylene, triacontylene, cyclohexylene, cyclooctylene, cyclododecylene, cyclododecylene, biphenyl, butenylene, penentylene, hexenylene, heptenylene, octenylene, nonenylene, decenylene, undecenylene, dodecenylene, hexynylene, heptynylene, octynylene, nonynylene, decynylene, undecynylene, dodecynylene, butadienylene, pentadienylene, hexadienylene, heptadienylene,

octadienylene, nonadienylene, decadienylene, undecadienylene, dodecadienylene, hexatrienylene, octatrienylene, decatrienylene, and dodecatrienylene radicals.

15. (Previously Presented) The composition of matter of Claim 2 wherein Y is biphenyl.

16. (Previously Presented) A composition of matter with the following formula:



wherein

M is a Group-8, -9, or -10 transition metal, excluding palladium,

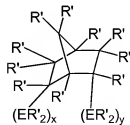
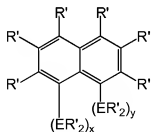
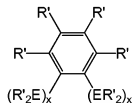
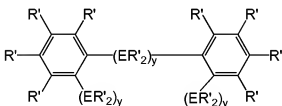
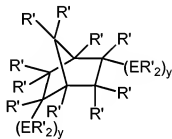
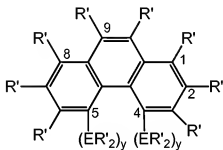
N is nitrogen;

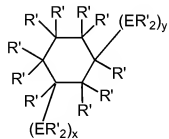
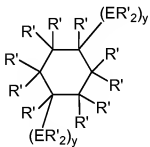
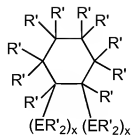
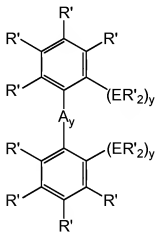
P is phosphorus;

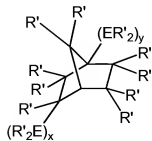
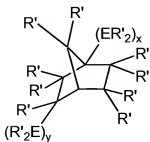
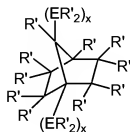
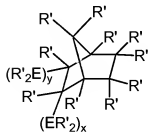
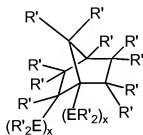
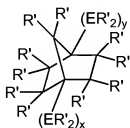
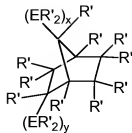
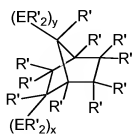
R¹, R², R³, and R⁴ are hydrocarbyl radicals;

each X is independently methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, hydride, phenyl, benzyl, phenethyl, tolyl, methoxy, ethoxy, propoxy, butoxy,

dimethylamino, diethylamino, methylethylamino, phenoxy, benzoxy, allyl, 1,1-dimethyl allyl, 2-carboxymethyl allyl, 1,1,1,5,5,5-hexa-fluoroacetylacetonate, 1,1,1-trifluoro-acetylacetonate, and 1,1,1-trifluoro-5,5-di-methylacetylacetonate, or the two X's are connected to form catecholate, 3,5-dibutylcatecholate, 3,6-dibutylcatecholate, 3,6-dibutyl-4,5-dimethoxycatecholate, 3,6-dibutyl-4,5-dichlorocatecholate, 3,6-dibutyl-4,5-dibromocatecholate, 1,3-propylene, or 1,4-butylene; and Y has one of the following formulas:







where

R' are hydrogen or C₁-C₅₀ hydrocarbyl radicals;

A is a non-hydrocarbon atom functional group;

E is a Group-14 element;

x is an integer from 1 to 4; and

y is an integer from 0 to 4.

17. (Previously Presented) The composition of Claim 16 wherein A is C=O, C=S, O, S, SO₂, NR*, PR*, BR*, SiR*₂, or GeR*₂ wherein each R* is a hydrocarbyl or halocarbyl radical.

18. (Withdrawn) A composition of matter comprising the reaction product of an activator and the composition of matter of Claim 2.

19. (Withdrawn) A composition of matter comprising the reaction product of

- (a) the composition of matter of Claim 18 and
- (b) ethylene, propylene, 1-butene, or a mixture of any two or all three of ethylene, propylene, and 1-butene.

20. (Withdrawn) A polymerization method comprising the step of providing at least one composition of matter of Claim 2.

21. (Withdrawn) The polymerization method of Claim 20 wherein the activity of the composition of matter exceeds 8000 moles of ethylene per mole transition metal per hour.

22. (Withdrawn) The polymerization method of Claim 20 further comprising recovering a product comprising greater than 50 wt% of linear C₄-C₁₄ α -olefins based on the total weight of polymerized product.

23. (Withdrawn) The polymerization method of Claim 22 wherein the product comprises greater than 80 wt% of linear C₄-C₁₄ α -olefins.

24. (Withdrawn) The polymerization method of Claim 23 wherein the product comprises greater than 50 wt% of linear C₄ and C₆ α -olefins.

25. (Withdrawn) The polymerization method of Claim 24 wherein the product comprises greater than 80 mol% of linear C₄ and C₆ α -olefins.

26. (Withdrawn) A composition of matter comprising the reaction product of:

- (a) an activator; and
- (b) a catalyst precursor with the formula of the composition of matter of claim 2, wherein:
 - (i) M is iron, nickel, or cobalt; and
 - (ii) R¹, R², R³, and R⁴ are independently methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, ethenyl, propenyl, butenyl, pentenyl, hexenyl, heptenyl, octenyl, nonenyl, decenyl, undecenyl, dodecenyl, ethynyl, propynyl, butynyl, pentynyl, hexynyl, heptynyl, octynyl, nonynyl, decynyl, undecynyl, dodecynyl, phenyl, benzyl, phenethyl, tolyl, cyclobutyl, cyclopentyl, cyclohexyl, cycloheptyl, cyclooctyl, cyclononyl, cyclodecyl, or cyclododecyl radicals.

27. (Withdrawn) A composition of matter comprising the reaction product of:

- (a) an activator; and
- (b) a catalyst precursor with the formula of the composition of matter of claim 2 wherein:
 - (i) M is nickel, iron, cobalt, platinum, ruthenium, rhodium, or iridium;
 - (ii) R^1 , R^2 , R^3 , and R^4 are independently methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, ethenyl, propenyl, butenyl, pentenyl, hexenyl, heptenyl, octenyl, nonenyl, decenyl, undecenyl, dodecenyl, ethynyl, propynyl, butynyl, pentynyl, hexynyl, heptynyl, octynyl, nonynyl, decynyl, undecynyl, dodecynyl, phenyl, benzyl, phenethyl, tolyl, cyclobutyl, cyclopentyl, cyclohexyl, cycloheptyl, cyclooctyl, cyclononyl, cyclodecyl, or cyclododecyl radicals; and
 - (iii) X are independently dimethylamide, diethylethoxide, phenoxide, methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, hydride, phenyl, benzyl, phenethyl, tolyl, dimethylamino, diethylamino, methylethylamino; or two X's are connected to form catecholate, 3,5-dibutylcatecholate, 3,6-dibutylcatecholate, 3,6-dibutyl-4,5-dimethoxycatecholate, 3,6-dibutyl-4,5-dichlorocatecholate, 3,6-dibutyl-4,5-dibromocatecholate, 1,3-propylene, or 1,4-butylene.

28. (Withdrawn) The composition of matter of claim 27 wherein

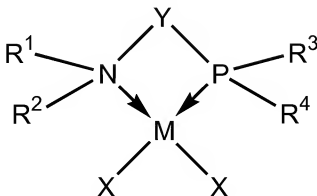
(i) R^1 , R^2 , R^3 , and R^4 are independently selected from methyl, ethyl, and propyl; and

(ii) Y is selected from butylene, pentylene, hexylene, heptylene, octylene, nonylene, decylene, undecylene, dodecylene, tridecylene, tetradecylene, pentadecylene, hexadecylene, heptadecylene, octadecylene, nonadecylene, eicosylene, heneicosylene, docosylene, tricosylene, tetracosylene, pentacosylene, hexacosylene, heptacosylene, octacosylene, nonacosylene, triacontylene, cyclohexylene, cyclooctylene, cyclododecylene, cyclododecylene, biphenyl, butenylene, penenylene, hexenylene, heptenylene, octenylene, nonenylene, decenylene, undecenylene, dodecenylene, hexynylene, heptynylene, octynylene, nonynylene, decynylene, undecynylene, dodecynylene, butadienylene, pentadienylene, hexadienylene, heptadienylene, octadienylene, nonadienylene, decadienylene, undecadienylene, dodecadienylene, hexatrienylene, octatrienylene, decatrienylene, and dodecatrienylene radicals.

29. (Withdrawn) A composition of matter comprising the reaction product of:

(a) an activator; and

a catalyst precursor with the following formula:



wherein

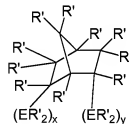
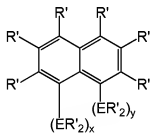
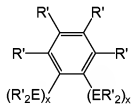
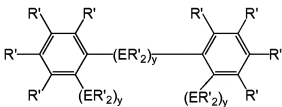
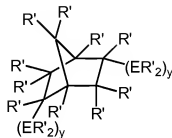
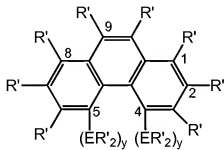
M is a Group-8, -9, or -10 transition metal, excluding palladium,

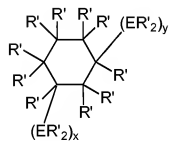
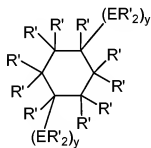
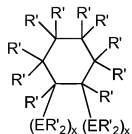
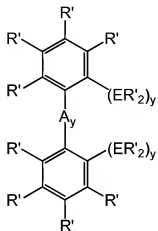
N is nitrogen;

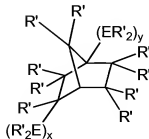
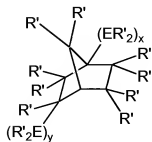
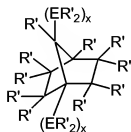
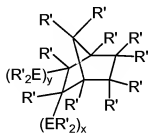
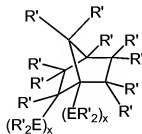
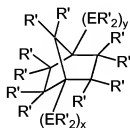
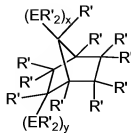
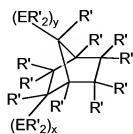
P is phosphorus;

R^1 , R^2 , R^3 , and R^4 are hydrocarbonyl radicals;

Y is represented by one of the following formulas:







where

- R' are independently, hydrogen or C_1 - C_{50} hydrocarbyl radicals;

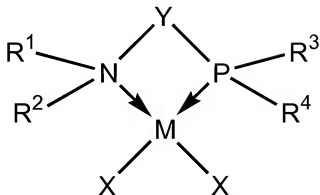
- A is a non-hydrocarbon atom functional group;
- E is a Group-14 element;
- x is an integer from 1 to 4;
- y is an integer from 0 to 4; and

X are independently dimethylamide, diethylethoxide, phenoxide, methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, hydride, phenyl, benzyl, phenethyl, tolyl, diethylamino, methylethylaminodimethylamin; or two X's are connected to form_catecholate, 3,5-dibutylcatecholate, 3,6-dibutylcatecholate, 3,6-dibutyl-4,5-dimethoxycatecholate, 3,6-dibutyl-4,5-dichlorocatecholate, 3,6-dibutyl-4,5-dibromocatecholate, 1,3-propylene, or 1,4-butylene.

30. (Withdrawn) A polymerization method wherein the catalysts activity exceeds 8000 moles of ethylene per mole transition metal per hour comprising the step of providing at least one composition of matter comprising the reaction product of:

(a) an activator; and

(b) a catalyst precursor with the following formula:



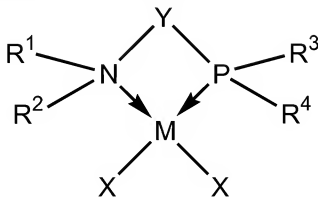
wherein

- (i) M is iron, nickel, or cobalt,
- (ii) N is nitrogen;
- (iii) P is phosphorus;
- (iv) R¹, R², R³, and R⁴ are independently methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, ethenyl, propenyl, butenyl, pentenyl, hexenyl, heptenyl, octenyl, nonenyl, decenyl, undecenyl, dodecenyl, ethynyl, propynyl, butynyl, pentynyl, hexynyl, heptynyl, octynyl, nonynyl, decynyl, undecynyl, dodecynyl, phenyl, benzyl, phenethyl, tolyl, cyclobutyl, cyclopentyl, cyclohexyl, cycloheptyl, cyclooctyl, cyclononyl, cyclodecyl, or cyclododecyl radicals;
- (v) Y is a hydrocarbyl bridge comprising a backbone wherein the backbone comprises a chain that is four or more carbon atoms long; and
- (vi) X are independently dimethylamide, diethylethoxide, phenoxide, methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl,

tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, hydride, phenyl, benzyl, phenethyl, tolyl, dimethylamino, diethylamino, methylethylamino; or two X's are connected to form catecholate, 3,5-dibutylcatecholate, 3,6-dibutylcatecholate, 3,6-dibutyl-4,5-dimethoxycatecholate, 3,6-dibutyl-4,5-dichlorocatecholate, 3,6-dibutyl-4,5-dibromocatecholate, 1,3-propylene, or 1,4-butylene.

31. (Withdrawn) A polymerization method wherein the catalysts activity exceeds 8000 moles of ethylene per mole transition metal per hour comprising the step of providing at least one composition of matter comprising the reaction product of:

- (a) an activator; and
- (b) a catalyst precursor with the following formula:



wherein

- (i) M is nickel, iron, cobalt, platinum, ruthenium, rhodium, or iridium;
- (ii) N is nitrogen;
- (iii) P is phosphorus;

(iv) R^1 , R^2 , R^3 , and R^4 are independently methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, ethenyl, propenyl, butenyl, pentenyl, hexenyl, heptenyl, octenyl, nonenyl, decenyl, undecenyl, dodecenyl, ethynyl, propynyl, butynyl, pentynyl, hexynyl, heptynyl, octynyl, nonynyl, decynyl, undecynyl, dodecynyl, phenyl, benzyl, phenethyl, tolyl, cyclobutyl, cyclopentyl, cyclohexyl, cycloheptyl, cyclooctyl, cyclononyl, cyclodecyl, or cyclododecyl radicals;

(v) Y is a hydrocarbyl bridge comprising a backbone wherein the backbone comprises a chain that is four or more carbon atoms long; and

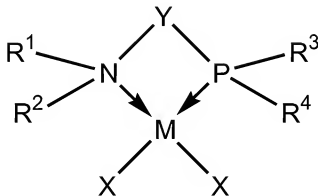
(vi) X are independently dimethylamide, diethylethoxide, phenoxide, methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, hydride, phenyl, benzyl, phenethyl, tolyl, dimethylamino, diethylamino, methylethylamino or two X's are connected to form catecholate, 3,5-dibutylcatecholate, 3,6-dibutylcatecholate, 3,6-dibutyl-4,5-dimethoxycatecholate, 3,6-dibutyl-4,5-dichlorocatecholate, 3,6-dibutyl-4,5-dibromocatecholate, 1,3-propylene, or 1,4-butylene.

32. (Withdrawn) The polymerization method of claim 31 wherein Y is a butylene, pentylene, hexylene, heptylene, octylene, nonylene, decylene, undecylene, dodecylene, tridecylene, tetradecylene, pentadecylene, hexadecylene, heptadecylene, octadecylene, nonadecylene, eicosylene, heneicosylene, docosylene, tricosylene, tetracosylene, pentacosylene, hexacosylene, heptacosylene, octacosylene, nonacosylene, triacontylene, cyclohexylene, cyclooctylene, cyclodecylene, cyclododecylene, biphenyl, butenylene,

penentylene, hexenylene, heptenylene, octenylene, nonenylene, decenylene, undecenylene, dodecenylene, hexynylene, heptynylene, octynylene, nonynylene, decynylene, undecynylene, dodecynylene, butadienylene, pentadienylene, hexadienylene, heptadienylene, octadienylene, nonadienylene, decadienylene, undecadienylene, dodecadienylene, hexatrienylene, octatrienylene, decatrienylene, or dodecatrienylene radical.

33. (Withdrawn) A polymerization method wherein the catalysts activity exceeds 8000 moles of ethylene per mole transition metal per hour comprising the step of providing at least one composition of matter comprising the reaction product of:

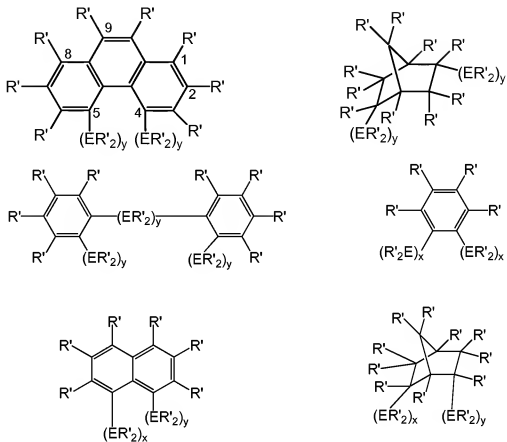
- (a) an activator; and
- (b) a catalyst precursor with the following formula:

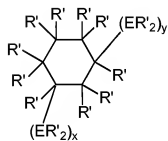
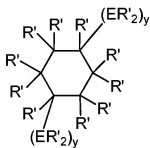
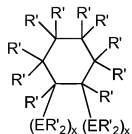
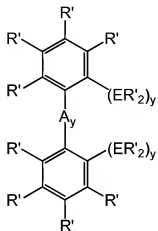


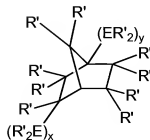
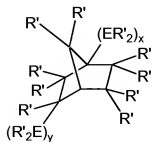
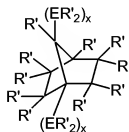
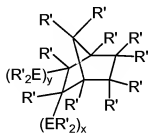
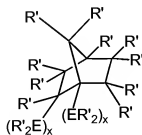
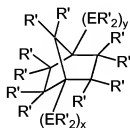
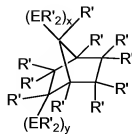
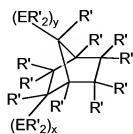
wherein

- (i) M is a Group-8, -9, or -10 transition metal,
- (ii) N is nitrogen;
- (iii) P is phosphorus;
- (iv) R¹, R², R³, and R⁴ are independently hydrocarbyl radicals;

(v) Y is represented by one of the following formulas:







Where

- R' are independently, hydrogen or C₁-C₅₀ hydrocarbyl radicals;
- A is a non-hydrocarbon atom functional group;
- E is a Group-14 element;
- x is an integer from 1 to 4; and
- y is an integer from 0 to 4; and

(vi) X are independently dimethylamide, diethylethoxide, phenoxide, methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, hydride, phenyl, benzyl, phenethyl, tolyl, dimethylamino, diethylamino, or methylethylamino.